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(An Educational Society)

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I shall pass through this world but once. Any good thing, therefore, that I can do, or any kindness that I can show to any human being, let me do it now. Let me neither defer nor neglect it, for I shall not pass this way again.—*Amiel.*

MONTHLY REVIEW

American Electro-Platers' Society

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Vol. 2 AUGUST No. 4

EDITORIALS—Cooperation,

Cooperation is the most effective way to secure the most of what each one desires to obtain.

There are two chief reasons for a lack of cooperation, one is that men do not agree on what is best to be done, the other is that selfish motives deceive men into thinking that they will be able to obtain more by going alone.

A visitor to a state hospital for the insane was walking over the grounds, half a mile from the main buildings, when he came across an attendant in charge of twenty patients.

The attendant was a small man, many of the patients were big men. The comparison aroused the visitor's curiosity. He joined the attendant in a stroll and among other questions he asked, "What is to hinder those men getting together and overpowering you, you admit that you are unarmed and there is no help within half a mile." The attendant smiled and replied, "Why if those men could get together with anybody or anything, they wouldn't be here."

The ability to organize is the badge of sanity.

Organization is the spirit of progress, you must stand for progress or fall.

If a man desires to obtain the most good for himself, he should know that his share of a great common good is greater than any possible good he could obtain for himself alone. The narrow minded man, fishes with a hook, thinking to have the whole catch to himself. The broad minded man joins with others in using a seine, and his portion of the returns exceeds by far what he might get with the hook.

We all need each other, therefore should cooperate with each other. The strength of unity is indisputable.

We are united by the strong mutual desire to further and improve our knowledge of the art of Electroplating, but the visible and tangible bond that unites us is the Monthly Review, without this we would be scattered, isolated bodies, without strength or cooperation, shut up within ourselves, dependent upon our own knowledge.

The Review is the cooperative worth of the Society, every branch, every member is requested, is expected to help make it what it should be: A valuable monthly educator. If the Review does not suit you, try to improve it, we need your help. We are trying to climb. We may occasionally stumble, but with mutual endeavor, unity and cooperation our progress must be upward.

H. J. RICHARDS.

A REAL RAPID PLATING NICKEL SOLUTION.

By E. S. THOMPSON, Chicago Branch.

I have chosen this subject because so much has been written on nickel plating and so many different formulas have been given without any one making any effort to give the reasons for rapid plating. The so-called rapid plating salts placed on the market are rapid plating considering the difference in the time required for a deposit from the old solutions and that of the new. But are they really rapid plating? The answer to the question as to why these salts are termed "rapid plating" has invariably been: They cause a rapid dissociation of the elements composing the nickel salt. They do not *cause* it. They only *permit* a rapid dissociation without the attendant troubles of the old double salts solution.

A solution composed of double sulphates of nickel and ammonia may be decomposed and the nickel separated as rapidly as desired, but I need not mention all the defects of rapid deposition from such a solution; they are too well known.

I do not claim any originality for the solution which I shall give. It has been used for several years and I have only improved upon the idea of someone else.

A solution composed of sulphate of nickel, chloride of sodium and boracic acid, is a solution which will deposit almost as fast as desired, the rapidity of the deposit depending upon the amount of ingredients mentioned per gallon and the temperature, also the quantity of current used. A solution composed of sulphate of nickel 18 ounces, chloride of sodium 12 ounces, boracic acid 4 ounces, water 1 gallon and a temperature of 60 deg. Fahr. gave a deposit in fifteen minutes with a current density of 50 amperes per square foot of surface, which buffed out more brilliantly than a casting of the same pattern which had been plated for two and one-half hours in a double salt solution.

Taking another casting of the same pattern, and heating the solution to 110 degrees Fahr. a deposit was obtained in three minutes which seemed to possess all the good qualities of the one at first plated in the solution at 60 deg. Fahr. using 200 amperes per square foot as the work plated in the solution while at a temperature of 110 deg. Fahr. This solution is used every day at a temperature of 50 to 60 deg. Fahr. and stove castings which formerly required to be run in the double salt solution 2½ to 3 hours for the first coating of nickel, and one hour for the second coating, are now finished more highly at a single operation and in less than half the time which was required for the first coating. There is no roughness, no discoloration, no peeling. Why? We will explain why.

In plating we must consider the chemical action and even the electrical action. While there is no electrical action in the separation of metal from its solvent under low current densities, yet, when the density of the current is raised above the quantity of the de-

oxidizing element or compound in the solution, the electricity has both a chemical and electrical action. The electrical action is the magnetization or the ionization of the metal in solution. The chemical action is the quiescent combustion of elements and the conversion of oxygen to ozone. This state of affairs is very undesirable, resulting in burned and granular deposits and the occlusion of hydrogen, making the deposit hard and brittle.

With the single salt solution above mentioned, the boracic acid is not decomposed, but is acted upon by the electrical element only so far as to be guided by it through the solution. Both nickel and hydrogen combine with the electricity, and the boracic acid follows by cohesive attraction and forces sulphurice acid out, the chlorine leaving the sodium to combine with the nickel, forming chloride of nickel, the sodium unites with the oxygen forced out of solution, and the sulphuric acid again combines with nickel at the anode.

At the cathode, the electricity leaves the hydrogen and nickel, the hydrogen unites with the chlorine set free to form hydrochloric acid, and the oxide of sodium in turn takes the chlorine into combination with sodium and the oxygen and hydrogen recombine to form water. It will be seen that the solution is automatic, that is, it recombines the elements set free and restores the solution to its original composition. As these changes are instantaneous, there is no escape of elements into the atmosphere. We need have no fear of burned or blistered deposits when about 12 ozs. of sulphate of nickel, 8 ozs. sodium chloride and 8 ozs. crystallized boracic acid are used to each gallon of water and the solution slightly heated. The rheostats may be thrown wide open and the full force of the current used.

This is the only nickel solution which I can say is absolutely rapid plating, although, I am experimenting with a more powerful oxidizer for nickel solutions, and will let the results be known to the A. E. S. as soon as my investigations are completed.

A friend is a person who knows all about you and likes you all the same.

There are several kinds of undesirable trusts, but trusting to luck is the limit.

A loose connection may not attract as much attention as a pulley out of balance, but it generally uses up more power in the long run.

Delegates and visitors who attended the Dayton Convention, will realize the pleasure it gives me to settle the question of nickel slime.

Many a good job of plating is spoiled by a poor job of buffing. Wonder how many jobs of poor plating have been saved by good buffing.

HISTORICAL REVIEW OF THE ELECTRICAL DEPOSITION OF COPPER.

WORK DONE AT NEWARK BRANCH.

Chemical Symbol Cu. Atomic weight 63.5—electro-chemical equivalent—63.5—31.75.

Valency 1 and 2. Specific gravity 8.96. Melts at 1200°C. or 3.2192°F. Next to silver the best known conductor of electricity, although the conductivity is liable to vary greatly on account of impurities.

Copper is found various forms throughout the earth—native, especially in the Lake Superior mines—one deposit is recorded weighing 480 tons, and the speciman was very pure.

It is found also as ores comprising chalcocite or copper glance Cu_2S. Chalcopydites or copper pyrites Cu_2S, Fe_2S_2? Cuprites or red oxide of copper CuO. Malachite and azurite, hydrated basic carbonates ($2Cu\ Co_3 + Cu.H_2O_2$). Borite or purple Cu. 3 $Cu_2S + Fe_2S_3$. Chryscolla, a silicate.

Copper was one of the first metals known to man, and we have records showing that it was found native in Palestine and Cyprus, it was often referred to in the Holy Writings as Bronze, probably Cu. alloyed with tin Sn.

REFINING. Cu. is refined from its ores by use of heat driving off the sulphides and other gases which are used as by-product and worked up as fertilizers and in a great many plants they use the by-products in the manufacture of sulphuric acid. The Cu. is run into pigs and then refined still further by remelting and poling and thus pure copper is obtained. Time would not permit me to get figures as to the quantity of copper thus refined even today, but I am sure it would be very interesting and instructive to make such compilation.

ELECTRO. As far as we know copper was first deposited by the aid of electricity about the year of our Lord, 1835, and while several men seem to have been experimenting along the same lines, and undoubtedly obtained similar results, but as to who was the first it will always be an unknown story. It is quite evident that through Societies formed for the purpose of scientific study and exchange of views, chemical and electrical research was stimulated, and as a result today we are following a profession that otherwise would never have been known, or to say the least would not have been developed until years afterwards.

It is also true that minds of great men run in the same channel. From a book published in the year 1845, Mr. Bessmer of Camdentown, London, England, stated that he had deposited copper on lead castings. The first printed accounts were given to the world by Mr. J. C. Jordan, in a letter written by him May 22, 1839, and published in the Mechanics' Magazine of June 2, 1839, although

Mr. Jordon had made his experiments in the summer of 1838. "In 1836 Mr. DeLa Rue devised a peculiar form of Daniell's battery and observed that the copper plate is also covered with a coating of copper and when the deposit was stripped off it had the counterpart of every scratch of the plate on which it was deposited"—(Philosophical Magazine, 1836).

"In 1837, Dr. Golding Bird decomposed by means of a voltaic current, solutions of chloride of sodium, potassium and ammonium and deposited their respective metals on a negative pole of mercury and thus obtained their amalgams" (Philosophical Transactions of the Royal Society, 1837).

"The publication of Mr. Spencer's paper excited general attention of persons of all classes and Societies, who became fascinated by the new art, and it is quite evident that it continues until this day. The first method employed was by the single cell method."

Records are given in various publications of the reproduction of metals and electrotypes made by the single cell method, and we can see today that while the method was slow, it was a very important step in the progress of the art of electro-deposition.

These early methods were soon followed by the separate current processes; among those help very much in the dissemination of the knowledge of the art, was Mr. C. W. Walker, Secretary to the London Electrical Society, in the publication in 1839 or 40 of a work in two volumes entitled "Electrotype manipulation"—in March, 1840, Messrs. Elkington of England obtained a patent for the use of prussiate of potash as a solvent of Au and Ag which was in reality pottasium cyanide.

Another patent by the same Company to copper plate on iron, clean thoroughly and plate in cyanide copper solution at 120 degrees F.; for 5 or 10 minutes, remove, scour with sand, plunge into sulphate of copper solution where they remained until the desired thickness was obtained. Should any black spots appear the articles will have to be removed and scoured and re-coppered in the cyanide solution and re-coppered in the sulphate solution. By the foregoing you will see that the men who were pioneers in the art were painstaking.

By degrees the battery method was followed by the use of a dynamo which proved a great uplift to the art of electro-deposition, of course, all here are familiar with the modern method and need not be renewed at this time.

Plating with copper is not the only use made of the electro-deposition of copper but there are refineries where this method is being extensively used. The same copper sulphate solution was used for refining as was used by J. C. Jordan in 1839. This gives chemically pure copper at the cathode and the impurities are percipitated at the bottom of the tank as mud, which is carefully removed and refined by the chemical method.

In a report compiled by Titus Ulke, and appearing in the Elec-

trical Review of New York and also in the "Electrician"—states that in eleven refineries in the United States, operative during the year 1900 the total production was estimated to be 516 tons daily, or 188,400 tons annually.

The method for refining copper by electrical process is very fully explained in work of Watt and Philipps, 1902. Much has been accomplished and we inherit valuable possessions from those who have labored faithfully in the development of this branch of the art, but surely there remains much to be done and we can only reap perfection by constant research and much will be expected of the American Electro-Platers Society, and I feel confident that we are going to live up to our privileges and opportunities.

"Determination of Copper in Plating Solutions."

Measure from a burette into a 250 CC. beaker, one avoirdupois assay gallon (or 13.35 CC.) of the solution to be assayed; add 10 CC. Cp. sulphuric acid and 50 CC. of water; then a piece of aluminum about one inch square, heat to boiling, allow to stand about one hour or until solution is colorless; at this point a few drops of hydrogen sulphite water added to the solution will show whether all copper has been reduced. If so, add 100 CC. of water, filter on a weighed porcelain grooch crucible in which a fibre asbestos pad has been inserted or on tared filter papers; wash until free from acid, dry at 100 degrees. C (not over an open flame or copper will oxidize and results will be high) then weigh.

Calculation. Number of decigrams found will correspond to avoirdupois ounces in U. S. gallon, times 3.95 will equal ounces of copper sulphate in the gallon. (Note—Where metals other than copper are present in solution they will be reduced and cause erroneous results.)

"Conductors for Copper Solutions."

Copper solutions are perhaps used more than any one of the other plating solutions, with the possible exception of nickel. As the ingredients of these solutions are good conductors in themselves, a large part of the copper solutions are used without the addition of any conducting salts except the copper used and cyanide.

This does not apply to the acid solution, which always has a large amount of free sulphuric acid as a conductor.

We will first consider the acid copper bath. This solution is usually made by dissolving copper sulphate in water until the hydrometer shows 16 degrees Be. If a solution was made of copper sulphate alone and electrolyzed, the ammeter would show a reading and a deposit of copper would be obtained. This would show the copper sulphate in the conductor. If, however, the current strength and anode surface were kept the same and some sulphuric acid were added, the ammeter would show a higher reading and the copper deposit would not only be increased, but the deposit would be of a finer and better structure, thus proving that sulphuric acid

is a good conductor in a copper sulphate bath and is necessary for good deposit.

In a solution of copper sulphate, one molecule breaks up into two small parts, copper being one and the sulphate radical being the other. These are called ions and are the substances which conduct the current in solutions. Substances which do not break up into ions in solution are non-conductors, sugar being an example; solutions of this salts do not conduct the current.

When the solution of copper sulphate is electrolyzed the copper is deposited as cathode and the sulphate radical travels to the annode, there it combines with an atom of copper from the annode and forms a molecule of copper sulphate. This molecule of copper sulphate breaks up into ions of copper sulphate and the process is repeated.

When sulphuric acid meets with water the sulphuric acid breaks up into a large number of hydrogen and sulphate ion. The more highly a substance breaks up into its ions, the better conductor it is. As sulphuric acid and water breaks up into a large number of ions it is a first-class conductor. Then what part does sulphuric acid per sulphate which goes into solution. The copper is deposited at play in a copper sulphate solution? When dilute sulphuric acid is electrolyzed the two hydrogen ions are deposited at the cathode and the sulphate radical is deposited at the annode; there the sulphate radical combines with some copper from the annode, forming cop- the cathode and the sulphate radical combines with the two hydrogen ions to form sulphuric acid. This process is repeated over and over again and the supply of acid and copper is kept constant. In plain language, when a solution of copper sulphate and sulphuric acid is mixed and the whole electrolyzed, the sulphuric acid furnishes so many sulphate radicals to combine with the copper from the annode that so much more copper is deposited from solution than if copper sulphate alone were used, and this copper sulphate is the real conducting power.

In the cyanide solutions there are several salts added for conducting purposes, but as copper cyanide or sodium or potassium cyanides are such good conductors, a large number of platers do not use any other salts in their solutions. The chief conducting salts used for cyanide solutions are, copper cyanide, sodium and potassium, cyanide, bisulphite of soda, carbonate of soda and hyposulphite of soda. We will eliminate the sodium and potassium cyanides as they are necessary for the depositing of the metal, and just consider those which are not actually necessary for the deposit of copper. Bisulphite of soda seems to have a tendency to keep the annodes clean and also help to keep the deposits right. The amounts that platers use vary, some solutions using as low as one and one-half to two ounces per gallon, while other solutions contain as high as seven and eight ounces per gallon. As bisulphite of soda is an acid salts, it will neutralize cyanide unless first neutralized by bicar-

bonate of soda which has an alkiline reaction; five ounces of bisulphite of soda will neutralize one ounce of potassium cyanide. If five ounces of bisulphite of soda is added to one gallon of solution it will neutralize one gallon of free cyanide which should be replaced by that amount. Carbonate of soda (sal soda) is also used in copper solutions in amounts varying from three to eight ounces to the gallon. The claim is made by some platers that it is of no real value in a copper solution, while others claim that the metal can be deposited faster without burning and that the deposit is of a finer texture when carbonate of soda is used; the latter being its chief asset.

Hyposulphite of soda is very commonly used in copper solutions as it helps to give a clear deposit and also helps to keep the depoist bright. The amounts recommended vary from 1/10 of an ounce to two ounces per gallon. It is used chiefly as a brightener. Ammonium chloride is also used, but it claimed that the chlorine liberated during electrolysis has a tendency to attract iron.

Ammonium sulphate is also used by some platers with satisfactory results.

"Brighteners for Copper Solutions."

There are several reagents used for depositing bright copper. But for the cyanide copper solution, carbonate of lead probably gives the best results. This brightening reagent may be made by dissolving 16 ounces caustic soda or potash in one gallon of water and then dissolving 8 ounces carbonate of lead in this solution. Only a small amount of this solution should be used at one time and each successive addition should be made carefully. By the use of carbonate of lead one of our members has deposited copper upon his work for four hours and the lustre has been retained for that period.

Borax is also used successfully as a brightener in a copper cyanide solution. About one quarter of an ounce to the gallon is used.

For acid copper solutions the brighteners used are usually yellow dextrine, glucose and transpirant white blue. These are soluble in hot water and about one quarter of ounce is added to each gallon of solution. Transpirant white blue is especially recommended.

Hyposulphite of soda may also be classed as a brightener for copper solutions and is used to bring up a good clear deposit of copper when the solution is running off color. The chief objection to this salt is that it must be added constantly in order to give good results. The oxidizing of copper having been thoroughly covered by a preceding paper, will not be touched here, but give a few special finishes of interest.

"Bronze Finishes on Copper."

Brown to Pink—A saturated solution of nitrate of copper to which add various proportions of ammonium chloride.

French Brown Bronze—Solution 1. Water ¾ of a gallon, copper sulphate three pounds. Solution 2. Water one quart, caus-

tic potash stick, one ounce, mix the two solutions and use hot.

TERRA COTTA BRONZE—Place in acid copper solution and lacquer slightly colored with a brown aniline dye then wax buff.

"RUST-PROOF BLACK, ESPECIALLY CUTLERY."

16 ounces of alcohol, 16 ounces spirits of nitre, one ounce of corrosive suplimate, dip work in this solution, let dry one-half hour in the air, transfer into an air tight drum, having an outlet for condensation at the bottom, then blow live steam, repetition of the above method will give more depth to the black.

DETERMINATION OF SILVER IN CYANIDE PLATING SOLUTION.

This method depends upon the converting of silver in a cyanide solution to a sulphide, then treating with nitric acid, forming silver Nitrate. In this state it may be determined by Volhard's Volumetric Method for the determination of silver, described in Sutin's book on "Volumetric Analysis", which is as follows:

"This method is based on the fact that when solutions of silver and an alkaline thiocyanate are mixed in the presence of a ferrio salt, so long as silver is in excess, the thiocyanate of that metal is precipitated, and any brown ferric thiocyanate which may form it at once decomposed. When, however, the thiocyanate is added in the slighest excess, brown ferric thiocyanate is formed, and asserts its color even in the presence of much free acid."

It will necessitate the use of a standard solution of ammonium thiocyanate, made up to such a strength that 1-cc. of the thiocyanate solution will equal one centigram of fine silver.

(1) STANDARD SOLUTION OF AMMONIUM THIOCYANATE:

This solution connot be prepared by weighing the thiocyanate direct, owing to the deliquescent nature of the salts, therefore about eight grams of thiocyanate salt may be dissolved in a liter of water as a basis for getting an exact solution, which must be finally adjusted by a correct decinormal silver solution.

(2) FERRIC AMMONIUM ALUM SOLUTION (Indicator)

This may consist simply of a saturated solution of the above salt; 5-cc. of this solution are used for each titration.

METHOD OF PROCEDURE.

Measure from burette into a 400-cc. breaker, 1 assay gallon (or 12.2-cc.) of the solution to be assayed, add 200-cc. of water and 20-cc. of ammonium sulphite, heat to boiling point, filter, wash four times with warm water, transfer precipitate and filter into same breaker, add 20-cc. of water and 20-cc. of C.P. nitric acid, heat to boiling point, *cool*, add 5-cc. Indicator and 200-cc. of water, then titrate to a pink color with ammonium thiocyanate solution.

CALCULATION.

cc's. required (one decigram being equal to one troy ounce)—ounces in one U. S. gallon.

Note: For explanation of above calculation, see Hall's new system of the assay gallon in the January issue of "Metal Industry."

ACID—COPPER SOLUTIONS.

By E. G. Lovering, Detroit Branch.

In this paper I will endeavor to put before you my personal experiments with the acid copper bath, appertaining to the electro deposition of copper on non-metallic surfaces, galvano-plastic electrolitic deposits. This is an art which at present is not very much practiced, owing to the high cost of production. In my opinion there is a large field to develop along these lines, and when our dynamo designers and manufacturers give us a dynamo that will generate from 1 to 2 volts at 500 to 5,000 amperes, we will be able to produce heavy deposits at a minimum cost.

I will first describe methods for making reproductions from embossed cardboard and plaster of paris bas reliefs. I dissolve as much copper sulphate as a gallon of water will take up, approximately about 4 parts of water will dissolve one part of copper sulphate, making the solution as concentrated as possible, then adding C. P. Sulphuric acid until the hydrometer raises from 4 to 5 degrees, the solution will then stand about 20, to this I add 2 ounces per gallon of grain alcohol and 1 ounce of oxalic acid. Now I will not attempt to describe the chemical reactions or relation these last two ingredients have, nor other organic matters often used, such as alum, molasses, grape sugar, etc., suffice it to say that from experience we know they show results. A solution with a high metallic content rich in metal using electrolitic copper annodes deposits faster with a smooth, fine grained deposit. The deposit from a weaker solution will be brittle, coarse grained and hard to remove without cracking.

In electrolitic refining of copper, a solution of sulphuric acid alone is used with a strong current. In producing a reproduction from a plaster of paris bas relief or embossed cardboard, the articles are first coated with varnish or shellac, which is allowed to dry, then the back and edge are given a coating of wax, which keeps them from warping when placed in solution. The face is then given a coating of lacquer, and allowed to dry, then brush off all loose bronze with a fine brush. They are then wired, weighted and plated, until the deposit is thick enough to remove. The plaster of paris designs may be given a coating of gutta percha, dissolved in benzole, which is allowed to soak in, after bronzing, they are dipped into a silver cyanide solution which deposits a thin film of silver on the bronze powder, then placed after washing in cold water into the copper bath and plated at first with a weak current, when the copper has deposited all over the design a stronger current can be used, as the copper is now depositing on what will be the back side of the mold, in from 10 to 12 hours the deposit will be thick enough to remove, after drying thoroughly, the deposit is removed from the design by inserting a knife blade under the deposit, and prying it loose. We now have a perfect opposite of the original, a mould,

from which we can produce as many reproductions as we desire. We will first clean it in potash, scratch brush it, if necessary buff it. Along the outer edge we will solder a thin strip of brass about ½ an inch wide, we will now go over the entire surface with a tincture of Iodide of Potassium dissolved in alcohol, the brass strip we will wax, which will prevent the copper from depositing over the edge. Wire and hang in the copper bath, in about 10 hours remove from bath, and the copper deposit can be removed from the copper mould, and the mould prepared for another deposit. The removed deposit will of course be an exact reproduction of the original and can be finished as desired.

Almost any non-metallic substance can be prepared for the plating bath and reproduced electrically by this method. Turkey feet, umbrella handles and even glass can be made to receive a copper deposit successfully.

SLIME IN NICKEL SOLUTIONS.

By Jos. Walters, Richmond, Va.

I wish to take issue with the exponent of the new gospel that "slime in nickel plating" is necessary and is the cream of all solutions.

The definition of slime is given by Webster Dictionary, "impurities, dirt, filth." The slime in a nickel vat should not be put in the same category with the high priced and noble metals—gold and silver.

The assertion is made that "I do not throw mine away but use up every particle of it." Will the gentlemen please tell us how he can accomplish it? I am compelled occasionally to filter my solutions and throw the slime out I refuse to hearken to the agonized cry of the filth and dirt.

Peace, peace oh let me rest in the bottom of your tank in peace.

If I permit it to accumulate there will be no peace.

The claim is also made "that when a nickel solution has no slime it does not work well." That depends on what condition the solution is. If chemically pure nickel salts is used free from iron and pure nickel anolds free from impurities there is little or no slime, and the deposited nickel from a solution not having any slime (which is mostly iron) is far superior for commercial purposes, because it contains little or no iron, and for that reason is less attacked by atmospheric conditions.

The more slime you allow to accumulate in your solutions the more will be deposited with the nickel. It is further claimed "that electricity has nothing more to do with the nickel after it has broken up the elements but that all with one accord act chemically and go to their distinct and respective places to carry on the process over

and over again, and thus a deposit of nickel falls physically upon the works."

This sounds like solving the problem of perpetual motion. Can anything be more pleasanter to the nickel plater than to make up his nickel electrotype hang in his cathodes, switch on the current for a moment or two, then stop the current and let the nickel plating go on "physically."

This Eutopian dream would be very nice and pleasant indeed if it would be true. Just to satisfy ourselves we tried it. We prepared a batch of work in the usual manner, hung it in the tank, turned on the current and switched it off after permitting it to flow for a minute or two, and watched for an hour to see if nickel would fall on the work "physically" and would you believe me no deposition of nickel took place.

It is true in electro-chemical work, like plating it is difficult and perhaps impossible to distinguish the exact conditions, where, electrically, chemically, or physically begins and stops. But this we do know that electro plating cannot be accomplished physically without the aid of electrical and chemical energy. To prove that nickel falls physically on the work the gentlemen cites the example of the "copper dip" saying it needs no dynamo, no voltage, no amperage, still a deposit takes place. The fact that iron dipped in a sulphate of copper becomes coated with copper is evidence that electrical action has generated chemical energy and causes an exchange of metals to take place. Thus $Cu\ SO_4 = Fe\ SO_4 + Cu$.

Iron being an electro positive metal and copper electro negative. When iron is brought in contact with copper sulphate electricity is produced and chemical action at the same time takes place. The iron is attacked by the acid of the copper sulphate and precipitated, and metallic copper crating the iron.

The point I wish to make clear is that when electro deposition takes place by simple immersion like copper and iron, it is done at the expense of the iron, an exchange of metals take place as an analysis after immersion it will be found that for a definite amount of copper deposited on the iron, a definite amount of iron will be found in the copper sulphate.

Electro deposition of nickel is a process entirely distinct and apart from deposition by immersion, because no exchange of an electro negative metal takes place for an electro positive one, and the comparison is odious and misleading, for no such condition can exist in nickel plating.

Conclusion.

In a nickel ammonium sulphate solution with the commercial 92% nickel anode impurities, from the salts and the anodes will accumulate in the form of a red slime and fall to the bottom of solution if kept alkaline. In a slightly acid solution some of it will be plated out but if enough acid is used to dissolve all of the impurities the solution would be too acid and no deposition of nickel could

take place, and if it were possible it is not practical nor desirable for the deposited metal would contain too much iron and affect the lasting qualities of the nickel plate.

If this slime is not filtered out of the solution and thrown away and if by accident a piece of work falls to the bottom and disturbs it the solution cannot be used until it has been allowed again to settle to the bottom and solution clear, for a very small part of it distributed through the solution the work is either plated in many cases rough like sand had been sprinkled and plated over, when such work is buffed it is then revealed in all its undesirable conditions, necessitating the removal of the nickel plate, necessitating the re-polishing and replating. This can be avoided by having a clear solution free of slime.

WHAT THE PLATER OUGHT TO KNOW.

THE METRIC SYSTEM. By F. A. SHEPHERD, Buffalo Branch.

The Metric System is simple, practical, sensible and decimal. As many of us are just starting on the scientific methods of handling our solutions, the best thing we can do is to start right, such being the case, we should adopt the Metric System and familiarize ourselves with it. The cumbrous, antiquated system of weights and measure with which business and science has been hampered with is passing away and the use of Metric System is spreading rapidly, among the nations, absolutely and indisputably presaging its universal adoption.

HISTORY OF THE METRIC SYSTEM. UNITED STATES.

In July, 1790, during the time that Thomas Jefferson was the Secretary of State he prepared at the request of Congress and delivered his Report on weights and measures, his object and what he proposed was, "to reduce every branch to the decimal ratio already established for coins, and thus bring the calculation of the principal affairs of life within the arithmetic of every man who can multiply and divide." This was approved by President Washington as well as Congress, but further action was deferred for the time being owing to the fact that it was reported that the French Assembly were preparing a similar system along those lines and it was thought that it would be possible to establish an International system.

FRENCH.

In 1791 a report was made to the French National Assembly its object was, "THE ESTABLISHMENT OF A SIMPLE SYSTEM, BASED ON AN ABSOLUTELY FIXED STANDARD." It was accepted and French Engineers were employed who measured and computed the earth quadrant (also called an arc of the meridian or on-fourth of circumference of a terrestrial merdian) by measuring an arc of the meriadian passing throug Barcelona, Spain, and Dunkirk, France, with great care.

In 1799, the work of the Engineers was completed and it was

decided to take one-ten-millionth part of the earth quadrant and adopt it as the standard and called the metre. Metric is the adjective (descriptive form) of the word metre or to measure, therefore it is a measure system based on the metre used to measure or determine length, area, volume and weight. As it DIVIDES OR MULTIPLIES BY TEN IT IS THEREFORE A DECIMAL SYSTEM. The FUNDAMENTAL UNIT OR BASE OF THE METRIC SYSTEM IS THE METRE AND IS A UNIT OF LENGTH it is approximately equal to one-ten-millionth part of the distance from the Equator to the North Pole by actual measurement. The metre was then (1799 or during the time of Napoleon Bonaparte who was the first Emperor of the French, it thus originated during the time of the French Revolution) declared by law as STANDARD and is practically 39.37 inches. The cube of the tenth part of a metre was adopted as the unit of capacity, and denominated or called a Litre, it is equivalent to a little less than a quart or .9464 quart. The weight of a litre of distilled water at its greatest density or at a temperature of four degrees centrigrade. (39.2°F.) was one Kilogramme as a litre contains 1000 cubic centimeters and weighs 1000 grams, one-thousanth part of this was taken so that one cubic centimetre will weight one gramme which was adopted as Standard for the weight unit.

It was the supposition at the time it was invented that the Metric System would be accepted as the Universal method of calculation but (at the same time the attempt was made to substitute the metric (or decimal) system for time instead of the duo-decimal (ten and two) the result was that the people became so confused and perplexed that) it was abandoned WITH THE EXECEPTION OF SCIENTIFIC COMPUTATIONS AND CALCULATIONS WHERE AN ABSOLUTE AND COMMON STANDARD IS POSITIVELY NECESSARY.

At the time the French Engineers made their survey they calculated the average length of a degree of latitude as about 69.042 miles, therefore it is a little less than what is now accepted or estimated at the Equator or 69.16.

Back to the U. S. A.

The metric system was made legal in the United States in 1866.

The International Bureau of Weights and Measures was established, with the United States as one of the members, which immediately took up the work of preparing the International prototypes (copies) of the standard metre and kilogramme each member of the Bureau to have one. The result of their work was that THE ARCHIVES OF PARIS HAVE A PLATINUM-IRIDIUM BAR WHICH HAS TWO LINES AND THE DISTANCE BETWEEN THESE IS THE STANDARD METRE AND THE STANDARD KILOGRAMME (1000 grams) IS PREPARED IN THE SAME WAY AND EACH OF THE GOVERNMENTS COMPOSING THE BUREAU HAVE AN EXACT DUPLI-

CATE. IF ALL OF THE COPIES WERE DESTROYED THEY COULD BE DUPLICATED AS THE LENGTH IS ALSO KNOWN IN TERMS OF THE WAVE LENGTH OF LIGHT.

1890 the Pharmacopeia (a book containing directions for the preparations of medicine US Pharmacopia costs $10 issued every year) of the United States adopted the Metric System for prescriptions.

In 1893 the metre was made the unit of measurement in the United States and the yard was defined in terms with reference to it (.9144 metres to yard).

The use of the metric system (International) is now required in the following dependencies and departments of the United States:

In Porto Rico by proclamation of Military Governor, 1899.

In the Philippines by act of Congress, 1901.

In coinage, the International Postal Service, and the determination of Electrical Measures, by revised statutes; in the medical work of both the war and navy departments by orders approved by the secretaries of the departments; and in the United States Health and Marine Service by regulation of the President in 1902.

Explanation of the System.

As a metre is equivalent to 39.3708 inches, this is the length now known as the metre and all other measures of weight and volume in the system are obtained and as the scale runs in tens it is simple and easy to find the comparative values of a given quantity.

A metre is subdivided into ten (decem) one hundred (centum) and one thousand (mille) parts. The subdivisions are indicated by the Latin prefixes indicating the fractions of the metre:

1 millimetre (mm) .001 metre .03937 in.

10 millimetres make 1 centimetre (cm) .01 metre .3937 in.

10 centimetres make one decimetre (dm) .1 metre 3.937 in.

10 decimetres make one metre (m) 1. metre 39.3708 in.

And for measures larger than a metre the prefixes are Greek and are also multiples of ten; ten (deka), one hundred (hekaton or hecto), one thousand (chilioi or kilo), and for ten thousand (myria). It should be observed that the abbreviations (mm, cm, dm and m) in the values less than a metre are made with small letters whereas in values larger the abbreviations are capital, as:

10 hechtometres make one kilometre (Km) 1000 metres 39380.8

10 dekametres make one hecktometre (Hm) 100 metres 3937.08 in.

10 hecktometres make one kilometre (Km) 1000 metres 39320.8 in.

Having observed that the above table adds or divides by ten, it will be remembered that is it linear measure the same as a ruler or a straight line.

Surface Measure.

Square or surface measure have the same terms excepting that instead of adding or dividing by tens, they increase or diminish in ratio of 100, which is naturally expected as mm^2 is one sq. mm. $10cm^2$. is 10cmx10cm or 100cm squared, or multiplied by itself once, etc., then:

.0001—100 sq. mm (mm^2) equals one sq. cm (cm^2) equals .15500 sq. inches.

.01—100 sq. centimetres equals one sq. dm. (dm^2) equals 15.500 sq. inches.

1. sqm.—100 sq. decimetres equals one sq. metre (m^2) equals 1550. sq. inches or 10.7639 sq. feet.

The multiples above a square metre are, Centiare, (sq. metre) Are, (100 m^2) Hectare, (10,000 sq. metres) etc., as a Hectare is equivalent to 2.4711431 acres it is evident that we will not be interested in any over the square metre.

Cubic Measure.

Cubic measure also has the same terms excepting that it will increase or diminish in the ratio of 1000, as a cube is represented in three dimensions or 10x10x10 equals 1000, or 10^3. (10 cubed)

.000001—1,000 cubic millimetres equal 1 cubic centimetre (cm^3 or cc) .061 cu. inch.

.001—1,000 cc (cm^3) equal one cubic decimetre (dm^3 or litre) 61.02705 cu. inches.

1 cu. m (m^3)—1,000 litres (dm^3) equal 1 cubic metre (Kilolitre or Stere) 61027.051 cu. inches.

As the litre is the unit in measures of capacity then the table would be Millilitre or 1cc; Centilitre or 10cc; Decilitre or 100cc; Litre or 1000cc; Dekalitre or Centistere (10,000cc or one hundredth part of a cubic metre); Hectolitre or Decistere; Kilolitre or Stere and past the Stere the Myrialitre which is ten Stere or one thousand litres.

Having observed that the litre of capacity is diminished or increased in the ratio of ten, instead of one thousand as would be expected in the cubic measurement, such will also be found to be the case with the gram as the unit of weight. As it was explained in the history how the gram was adopted and originated it will not be necessary to repeat it here but it makes the solution very clear and easily understood therefore:

One cubic decimetre (1 litre) of water at 4°C. (39.2°F.) weighs exactly one Kilogram or 1000 grams and as the cube of 10 is 1000 then dividing by ten we get 100 (centi) and dividing 100 by ten we get 10 (deci) again dividing 10 by 10 we get 1 (milli), and this is what is done with the gram as one litre weighs 1 Kilogram or 1000 grams then one thousandth of a litre or 1 cubic centimetre (cc) weighs exactly 1 gram, and, representing 1 gram as one

thousand, and dividing as explained, we get the submultiples or fractions of a gram and the smallest of which is the milligram or one thousandth part of a gram (.001); then:

100 milligrams (mg)=1 centigram (cg.)=15432 grains=.000332 oz. Troy .000022 Adv. lb.

10 centigrams=1 decigram (dg.)=1.54323 grains=.003215 oz. Troy .0002205 Adv. lb.

10 decigrams=1 gram (g)=15.43235 grains=.032151 oz. Troy .0022046 Adv. lb.

10 grams=1 Dekagramme (Dg)=154.32349 grains=.321507 oz. Troy .0220462 Adv. lb.

10 Dekagrams=1 Hektogram (Hg)=1543.23488 grains=3.215073 oz. Troy .2204621 Adv. lb.

10 Hektograms=1 Kilogramme (Kg)=15432.34880 grains=32.150727 oz. Troy 2.2046213 Adv. lb.

10 Kilogramme=1 Myriagramme (Mg.)=154323.48800 grains=321.5072670 oz. Troy 22.0462126 Adv. lb.

100 Myriagramme=1 metric ton; 32150.7267 oz. Troy 2204.62126 and a metric ton is the weight of one cubic metre of water at 4°C. and is equal to 1.1023 tons of 2000 pounds.

(To be Continued.)

WHAT THE BRANCHES ARE DOING.

NEW YORK

The regular monthly meeting of the New York Branch of the American Electro-Platers Society was held Friday evening, August 27th at their rooms, 258 Pearl Street, New York, with President Reama in the chair. The laboratory committee is making preparations for the coming winter seasons and hope to make it interesting for the members.

The question of what laboratory work will best suit the plater, was a subject for discussion and finally decided that the actual making up of solutions and testing them and working them and analyzing them for their metal content and demonstrating the principles upon which they work, and the staining and shading and bronzing and finishing and the general methods used in the trade, would be nearer to the platers' desires than going deep into qualitative analysis.

Meets second and fourth Friday of each month at 258 Pearl Street, New York City, 8 p. m. Secretary, Wm. Fischer, 345 East 23rd Street, New York City.

Our members are pleased to know that Prof. Joseph W. Richards, of Lehigh University, an honorary member of our Supreme Society, has been honored by being selected as a member of the new Naval Advisory Board by Secretary of Navy Daniels.

BRIDGEPORT

Meets third Friday of each month at the office of the Brass World, 260 John Street, Bridgeport, Conn. Secrtary, Nelson Barnard, 858 Howard Ave., Bridgeport, Conn.

PHILADELPHIA

Meets first Friday of each month in the Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, Philip Uhl, 2432 North Twenty-ninth Street, Philadelphia, Pa.

The regular monthly meeting of this branch was held at the University of Pennsylvania, September 3rd. President Samuel Barr presiding and a good attendance. A communication from New York branch protesting against the admission of assistant foreman platers into the society was read. Without any discussion this branch took a vote and unanimously opposed to their admission. After the regular order of business a general discussion was held on different subjects during which Mr. Heck suggested to the members to experiment with Acetic Acid in nickel solutions as he has had good results from the same.

NEWARK

Meets first and third Friday of each month, 8 p. m., 47 Bank Street, Newark, N. J. Secretary, Geo. Reuter, Jr., 333 S. 19th Street, Newark, N. J.

CINCINNATI

Meets once each month at Dennison Hotel, Cincinnati, Ohio. Secretary, F. H. Nordmann, 720 Froom Ave., Cincinnati, Ohio.

CHICAGO

Meets fourth Saturday of each month, 8 p. m., Western Building, Randolph Street and Michigan Avenue. Secretary, H. E. Willmore, 5911 South Boulevard, Chicago, Ill.

The regular monthly meeting was held Saturday, August 28th, with O. E. Servis presiding and a fair attendance.

A paper prepared by Louis Schulte was read dealing with the details of the Metric System.

Communications were read from various branches protesting against the 30% per capita tax, the charge of 10c per copy for the Review and the admission of assistant foreman platers into the Society.

A question as to be cause of the coating over of anodes in a bronze solution was discussed, and it was suggested as a remedy that a small amount of caustic potash be added if the solution contained a sufficient amount of free cyanide.

ROCHESTER

Meets second and fourth Friday of each month at University of Rochester. Secretary, C. V. Haring, 603 Dewey Avenue, Rochester, N. Y.

BUFFALO

Meets first Saturday of each month at the University of Buffalo, 8 p. m. Secretary, John G. Murphy, 71 Dingens Street, Buffalo, N. Y.

ST. LOUIS

Meets fourth Saturday of each month at Public Library Assembly Rooms. Secretary, F. C. Rushton, 4405 Blair Avenue, St. Louis, Mo.

The August meeting of the St. Louis Branch was held at the residence of Mr. H. Duebelbeis. A baseball match had previously been arranged between Single and Double Nickel Salts, and while Mr. Robins on Single Salts side made several good hits, the excellent fielding of Mr. Lamkemeyer on Double Salts side, offset the advantage gained.

It seemed to be the general opinion that while Single Salts was a coming and progressive team, that it would be sometime before they replaced Double Salts as a safe and reliable pennant winner.

Letters of regret were read from Messrs. McCarthy, Weggandt and Heil. Mr. Heil's letter caused lots of laughter.

The question was asked as to whether work cleaned in the electric cleaner was harder to buff than work scoured with pumice, the general opinion was that work cleaned in the electric cleaner should buff the easier.

The action of the Supreme Executive Board in charging 10c per copy for the Monthly Review was brought up and it was unanimously voted that the St. Louis Branch wished to go on record as being in favor of the per capita tax being raised sufficient to cover all necessary expenses of the Supreme Executive Board, including Monthly Review.

At the conclusion of the meeting a vote of thanks was tendered to Mr. and Mrs. Duebelbeis for their generous hospitality, and all regretted when it was time to go home.

TOLEDO

Meets every Wednesday at Toledo University. Secretary, James E. Nagle, 209 Navarre Avenue, Toledo, Ohio.

INDIANAPOLIS

Meets last Saturday of each month at Hotel Dennison. Secretary, Artes Nelson, 1617 Shelby Street, Indianapolis, Ind.

TORONTO

Meets fourth Thursday of each month at Occidental Hall, Bathurst and Queen Streets. Secretary, Ernest Coles, P. O. Box 5, Coleman P. O., Toronto, Ont.

The regular meeting of the Toronto Branch was held on Thursday, August 26th. President Solmon presiding over a good attendance of enthusiastic members.

The routine business was disposed of with dispatch. The two protests to the amendments to the constitution made at the Dayton Convention, not meeting with the approval of this branch, and the great feature "Good and Welfare," called. A question was asked during the discussion on Cyanide Copper Solutions, at the July meeting as to why the anodes in a Cyanide Copper invariable cut at a point in line with the surface of the solution, and Mr. Barrow read an article on the "strata" of solutions and Mr. J. Acheson told of experiments he had made along that line, the sum of both speakers' remarks being that the surface of a still solution contains considerable more Cyanide or hydrogen than elsewhere. A general talk on tin plating and another brief reference to Cyanide Copper, being the principal items of a general discussion on plating subjects which was very interesting.

DAYTON

Meets first Wednesday of each month at the Y. M. C. A., Dayton, Ohio. Secretary, Alphonz Lamoureux, 500 East First Street, Dayton, Ohio.

The regular August meeting of Dayton Branch was held on Wednesday, August 4, with a large and enthusiastic attendance after disposing of the routine business before the Branch, a letter from New York Branch was read, objecting to the amendment passed at our last Convention admitting the assistant foreman platers to membership to our Society, but the members of Dayton Branch could see no danger in the amendment, so went on record as being in favor of leaving it stand as passed.

Mr. Robt. Suman read a very interesting article on the coloring of adhesive metal stamps and exhibited about 200 very beautiful samples of his work in this line. Mr. Chas H. Proctor the Father of our Society was present and gave the members present a very interesting talk on the work and progress of the Society in general. and as Mr. Proctor is always a welcome visitor, he was enthusiastically received by the members of Dayton Branch.

CLEVELAND

Meets last Saturday of each month at Central Y. M. C. A. Secretary, Charles Werft, 331 Strathmore Avenue, Cleveland, Ohio.

The monthly meeting of the Cleveland Branch was held August 28th, with a good attendance of members, since the vacation months are over the members are beginning to attend regular.

Mr. H. J. Ter Doest read a paper on Metalizing wood, and Mr. Chas. Werft had a paper on depositing copper on plaster of paris, both papers being well received, and interesting discussions followed, one of the questions brought out was, what caused acid copper to plate streaked, or what caused the streaks on acid copper deposit? Can soneone of the members at large inform this Branch?

MILWAUKEE

Meets first Friday of each month at Eagles Hall, 137 Second Street. Secretary, E. C. Yaeger, 962 9th Street, Milwaukee, Wis.

DETROIT

Meets first Friday of each month at Prismatic Hall, 140 1st Street. Secretary, B. E. Miller, 543 Townsend Avenue, Detroit, Mich.

Our regular meeting September 3rd, was called to order by President A. E. Wetmore in the chair and a large attendance of members were present.

Moved and supported that this Branch go on record as being in favor of the amendment assesing each member 10c for the Monthly Review, which was carried.

SUPREME SOCIETY NOTES

The constitution editing commission having concluded its work, the revised version has been reviewed by the Executive Board and as soon as a few minor details are satisfactorily settled, the copy will be placed in the printer's hands.

The trophy award for exhibits at annual convention has been delayed, pending the consideration of suggestions received by the Executive Board. The question will no doubt be decided before the publication of all papers presented at Dayton, and the award for best paper will be made after a vote is taken by the various branches.

CONCERNING PAYMENT OF DUES.

Members who have not paid their first quarter's dues for current year are now in arrears.

Our constitution reads as follows:

The annual dues shall be five dollars per year, payable annually, semi-annually or quarterly. New members shall begin to pay dues for the quarter in which they are elected.

Members whose dues are not paid by the end of each quarter shall not be entitled to benefits until same are paid.

Our fiscal year begins with June 1st.

Change of Address

Otto W. Mott	2039 N. 21st St., Philadelphia, Pa.
Milton Kutz	941 Drexel Bldg., Philadelphia, Pa.
E. L. Eckenrode	6626 Greenwood Ave., Chicago, Ill.
Chas. Relitz	2949 N. Ashland Ave., Chicago, Ill.
Louis Schulte	2940 N. Racine Ave., Chicago, Ill.
Wm. Voss	3164 Monroe St., Chicago, Ill.
E. R. Williams	211 Sixth St., Streator, Ill.
J. C. Orr	281 Westmoreland Ave., Toronto, Ont.
John Acheson	550 St. Clarens Ave., Toronto, Ont.
Jos. Wooldridge	Leland Hotel, Carelton Place, Ont.

Applications for Membership

NEW YORK BRANCH:

N. Bintners (associate)...Ave. D, near Boulevard, College Point, L. I.
Mr. Moller (associate(.....362 Eighty-sixth St., Brooklyn, N. Y.

TORONTO BRANCH:

James R. Moore.....Box 200, Carleton Place, Ont.

CHICAGO BRANCH:

H. H. Wolverton.....% Kalamazoo Stove Co., Kalamazoo, Mich.
Anton V. Sedlack.....307 South Second Ave., Maywood, Ill.
Rudolph J. Hazucher.....1842 Barry Ave., Chicago, Ill.

CINCINNATI BRANCH:

O. W. Jantz (associate).....York and Western St., Cincinnati, O.

INDIANAPOLIS BRANCH:

Richard P. Hennessy.....3707 Robson St., Indianapolis, Ind.

Elected to Membership

DAYTON BRANCH:

C. F. Athy.....302½ S. Ludlow Ave., Springfield, O
F. W. Page.....W. North St., Piqua, O.
H. M. Williams (honorary)...Chemical Eng. Nat'l Cash Register Co.,
Dayton, Ohio.
Rudolph S. Meister.....217 Rising Main St., N. S., Pittsburg, Pa.

CINCINNATI BRANCH:

Chas. Deitsch.....1028 Strum Ave., Cincinnati, O.

CHICAGO BRANCH:

V. E. Starner.....211 Fifth Ave., Minneapolis, Minn.
B. R. Congdon.....1129 Jones St., Fort Wayne, Ind.
A. O. Norberg.....3621 N. Sawyer Ave., Chicago, Ill.
G. A. Johnson.....3744 N. Racine Ave., Chicago, Ill.

PHILADELPHIA BRANCH:

Chas. V. Bayer.....2444 S. 20th St., Philadelphia, Pa.

NEW YORK BRANCH:

E. N. Pintner.....Colledge Point, New York

Matter for insertion in these columns must reach the editor not later than the 10th of each month.